11th Gen Intel(R) Core(TM) i5-1135G7 @ 2.40GHz   2.42 GHz
16.0 GB
4 Cores/8 Threads
Windows 11
Sania Ahmad

Q. What is Multithreading mergeSort?

Ans. In Multithreading mergeSort instead of making the main thread do all of the work, we are spawning multiple threads and assigning them the divided work to sort the given array to achieve parallelism. This improves the time taken up by the program to complete its execution as multiple threads are doing the work simultaneously.

- In my program I am using 4 different threads to achieve parallelism.

Q. How is the work being divided between 4 threads?

Ans. Considering the length of the array, we are first checking if it is perfectly divisible by 4, if so then we are dividing equal no. of elements to each thread, otherwise we are assigning (len/3) elements to 3 of the threads and the last thread being assigned with the reamaning number of elements. After this we join the threads and merge the 4 parts of the array together.

- Java Scheduler manages and coordinates the dispatching, execution and joining of each thread in the program based on defined schedules or conditions.

Optimization done in multithreading merge-sort:

- Instead of calling the norm function while comparing the two points of type (PointN) over and over again, we can calculate the value of the norm for a point object at the time of its instantiation. This will improve the time of execution by avoiding calling of the norm function.

Algorithm	Size	Execution time(ms)	Speed-Up
Single-threaded (baseline)	1000	0.96	-
Multi-threaded		1.86	0.5161
Multi-threaded w. manual optimization		1.42	0.6760
Single-threaded (baseline)	10000	9.26	-
Multi-threaded		5.66	1.6360
Multi-threaded w. manual optimization		2.66	3.4812
Single-threaded (baseline)	100000	109.0	-
Multi-threaded		49.6	2.1975
Multi-threaded w. manual optimization		15.24	7.1522
Single-threaded (baseline)	1000000	1371.96	-
Multi-threaded		641.56	2.1384
Multi-threaded w. manual optimization		200.66	6.8372

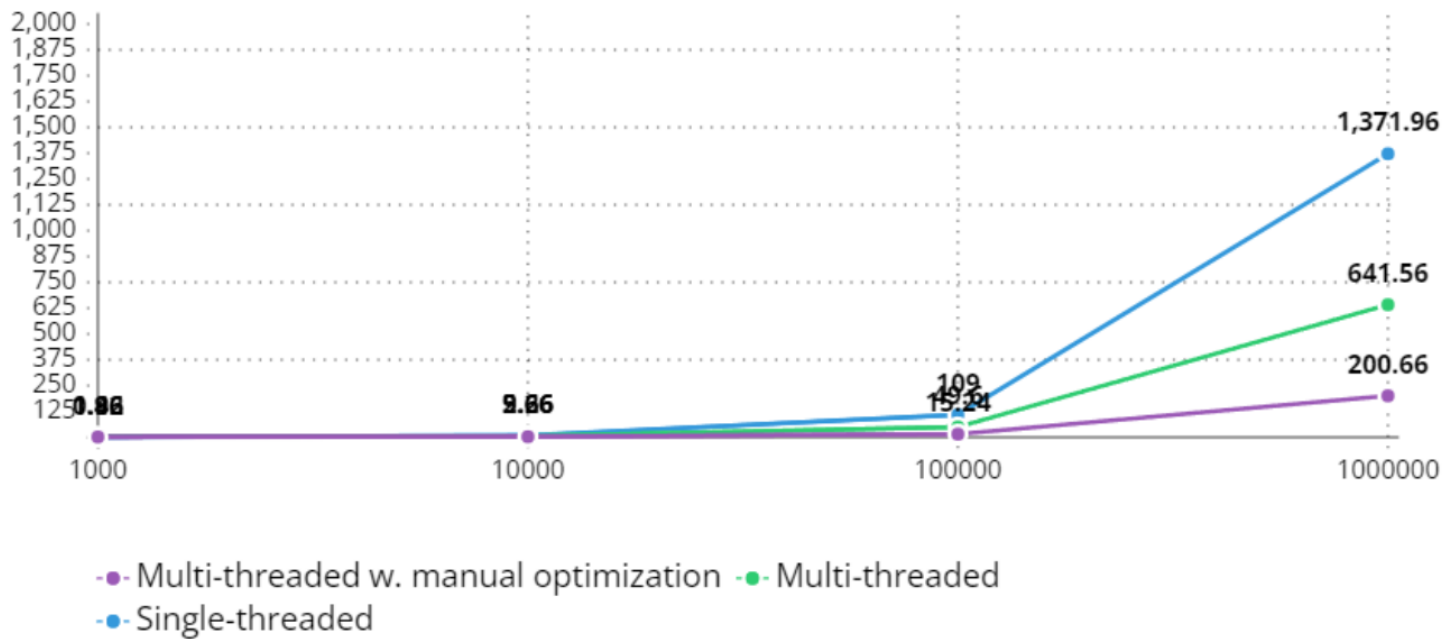11th Gen Intel(R) Core(TM) i5-1135G7 @ 2.40GHz   2.42 GHz
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Single Threaded time for size=1000 : 0.96

Multi Threaded time for size=1000 : 1.86

Multi Threaded with optimization time for size=1000 : 1.42

Single Threaded time for size=10000 : 9.26

Multi Threaded time for size=10000 : 5.66

Multi Threaded with optimization time for size=10000 : 2.66

Single Threaded time for size=100000 : 109.0

Multi Threaded time for size=100000 : 49.6

Multi Threaded with optimization time for size=100000 : 15.24